Fig. 13. *Wixia abdominalis*, sp. n.
a, Spider in profile, enlarged; *b*, cephalothorax of ditto in profile; *c*, caput and eyes, from in front; *d*, abdomen, from behind; *e*, maxillæ and labium; *f*, natural length of abdomen to extremity of protuberance; *g*, natural length of Spider (from base of falces to just above the spinners).

14. *Mago intenta*, sp. n.
a, Spider enlarged; *b*, ditto in profile; *c*, left palpus; *d*, ditto, from outer side; *e*, natural length of Spider.

2. Note on an Abnormal Specimen of *Pithecia satanas*. By W. A. Forbes, B.A., Prosector to the Society.

[Received April 18, 1882.]

A young male specimen of *Pithecia satanas*, which was lately forwarded to the Society's Gardens, and died shortly after its arrival, presented an abnormal condition that is perhaps worth recording in the Society's 'Proceedings.'

The peculiarity consists in the completely "webbed" condition of the third and fourth digits of the manus on each side, these two fingers being completely connected together down to their tips by a fold of nude skin, and with their nails closely apposed, though not connected, along their contiguous margins. The other digits of the hands, as well as all of those of the feet, are quite normal, the webbing of them not extending beyond the middle of the first phalanx.

The case is interesting, partly as affording an excellent instance of an abnormal condition affecting homologous parts of opposite sides in an exactly similar way, and partly as showing that the lower Primates are subject, occasionally, to a condition of things which, as is well known, also occurs not at all rarely in Man.

3. On some Points in the Anatomy of the Todies (*Todidæ*), and on the Affinities of that Group. By W. A. Forbes, B.A., Prosector to the Society.

[Received May 15, 1882.]

One of the few important forms of birds that the late Prof. Garrod had not an opportunity, at some time or other, of dissecting was the genus *Todus*, the sole representative of the family Todidæ. I was therefore much gratified at being able to examine, some months ago, a spirit-specimen of *Todus viridis*, which was placed at my disposal for dissection by Prof. Newton with his accustomed liberality; but I hesitated to publish my notes without having further material to confirm my observations. An opportunity of doing this has lately been afforded to me by the kindness of Prof. Baird and the authorities of the Smithsonian Institution in Washington, who forwarded to me, with other valuable specimens, four examples in spirit of the Tody of San Domingo (*Todus dominicensis*). It is on the examination of these two species that the following paper is based.

Dr. Murie has given us, in his article on *Todus*,[1] an exhaustive account of the opinions held by previous writers as to the position of the Todies, as well as a valuable description of their osteology, and reference to what was known of their visceral anatomy. To this paper I therefore refer any reader interested in the literary history of the group in question. Since its publication Sundevall, Garrod, and Sclater have all treated of the classification of birds.

The Swedish ornithologist[2], relying as usual solely upon external characters, was misled into placing *Todus* amongst the Passeres, in the close vicinity of the Tyrannidæ and Pipridæ, though in the same year Mr. Sclater pointed out[3] the impropriety of such a position.

Garrod at first [4] made the *Todinæ* with doubt a subfamily of the Coraciidæ, the *Momotinæ* forming another; but subsequently, on discovering that the Momotidæ lacked colic cæca[5], removed the latter altogether from the group of Passeriformes, and, adopting the opinion of Murie, Sclater, and others as to the close affinities of *Todus* to the Motmots, included the Todidæ with them, the two "almost certainly forming a single family." Mr. Sclater, in his lately published opinions on the classification of birds[6], maintains his earlier view, the Todidæ being placed nearest the Momotidæ. My better opportunities for observation do not allow me to fall in with the opinion of the last two distinguished naturalists. Reserving for the present comparison, I append my notes on the dissection of the two species of *Todus* I have examined.

The tongue is elongated, about ·75 inch long, flat and thin, nearly parallel-sided, though slightly tapering apically, and of horny consistence for most of its length. The root of the tongue, which is more fleshy, has some small spines developed along its base and for a short distance along the lateral margins. These margins anterior to this are frayed-out or ciliated, the direction of the laminæ so produced being backwards; the tip itself is quite entire. There is no crop; the proventriculus is, as usual, zonary; and the stomach (containing insects and seeds in the specimen examined) is a fairly muscular gizzard, lined by hard epithelium. The right lobe of the liver is much larger than the left. The intestines are remarkably short, their total length not exceeding $3\frac{1}{4}$ inches. The cæca are well-developed[7], and large for the size of the bird, measuring about one third of an inch. Their shape is that constantly met with in all the non-Passerine Anomalogonatous birds possessing cæca—narrowed towards their insertion, and dilated apically. There are two carotid arteries.

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[1] "On the skeleton of *Todus*, with remarks as to its allies," P. Z. S. 1872, pp. 664–680, pl. lv.

[2] 'Tentamen,' p. 60: Stockholm, 1872.

[3] Ibis, 1872, p. 179.

[4] Coll. Papers, p. 216.

[5] *L. c.* p. 427. The contrary had been asserted by Blyth and Murie.

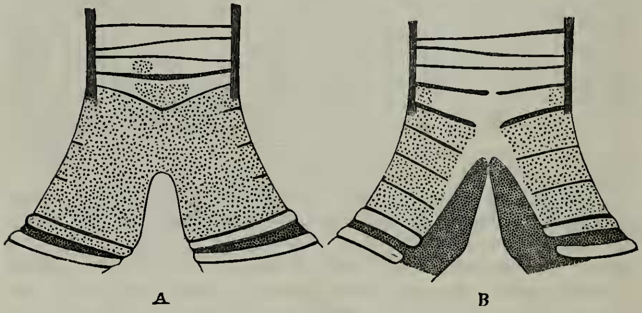
[6] Ibis, 1880, p. 401.

[7] They are erroneously stated by Duvernoy (Anat. Comp. Cuv. iv. [2] p. 284) to be absent.

In the leg, the ambiens and accessory femoro-caudal muscles are absent, as are the gluteus quintus and primus. The femoro-caudal, semitendinosus, and accessory semitendinosus are all well developed. The myological formula is thus —A. XY. The obturator internus is triangular. The deep plantar flexor tendons of the toes blend about three quarters down the leg, the slip to the hallux being given off from the inner of the two tendons a little before it joins the other one.

The pectoralis secundus extends nearly to the end of the sternum. There is no third pectoral, nor biceps slip to the patagium. The *expansor secundariorum* muscle, on the other hand, is well developed, the long thin tendon ceasing on the axillary margin of the *teres* muscle in a way hitherto only known in some of the Gallinaceæ[1]. I find, however, that exactly the same condition occurs in *Momotus* (*lessoni*) and *Hylomanes* (*gularis*), in some of the Alcedinidæ (e. g. *Tanysiptera*, *Syma*, and *Cittura*), as also in *Steatornis*. The presence of this muscle at all in these groups of birds was, I may remark, hitherto unknown[2]. The *tensor patagii brevis* at its termination has an arrangement almost identical with that of the Momotidæ[3], only differing from it in the absence of the thin slip of fascia which is continued, in them, from the recurrent "passeriniform" tendon to the fascia covering the ulnar side of the forearm. The deltoid has no special tendinous slip of origin from the scapula.

Fig. 1.



Syrinx of *Todus*: A, from before; B, from behind.

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[1] *Cf.* Garrod, Coll. Papers, p. 324.

[2] Besides the Coraciidæ, the existence in which of this muscle was pointed out by Garrod (Coll. Papers, p. 324), it exists also of the same "ciconiiform" shape in the Meropidæ, *Leptosoma* (P. Z. S. 1880, p. 470), and, as already noted in MS. by Garrod, in the Galbulidæ. It is absent in all (? Bucconidæ) the other families of Anomalogonatæ.

[3] *Cf.* Garrod, loc. cit. p. 359.

The triceps is Y-shaped at its scapular origin, and receives no tendinous slip from the humerus.

The construction of the syrinx may be best understood from an inspection of the accompanying figures (p. 444), representing the anterior (A) and posterior (B) views of that of *Todus dominicensis.* The trachea terminates below in an ossified bony box, formed of three or four modified rings (probably bronchial) fused together, as is very evident in the posterior view: as may also be seen there, the two preceding tracheal rings are coossified with this box in the middle line posteriorly, though in front they are quite free from it. The box is deeply notched in front, a narrow pessular bar running backwards from the apex of the notch, forming a three-way piece. The bronchial semirings succeeding the box have the normal character. The lateral muscle of the trachea continues downwards to terminate just on the upper limits of this syringeal box. The syrinx of *Todus viridis* is constructed on exactly the same plan.

Comparing these figures with those of *Momotus lessoni* given by Garrod[1], it will be seen that *Todus* differs from *Momotus* in its syringeal box being deeply notched anteriorly, and much more perfect posteriorly, the two parts being united by a pessular bar unrepresented in *Momotus.* In fact it resembles that of the Alcedinidæ or Galbulidæ rather than that of the Momotidæ. The chief difference from the former is that in the Alcedinidæ the intrinsic muscle, often very broad, passes down over the syringeal box to be inserted on one or more of the movable bronchial semirings, instead of ceasing before doing so, as in *Todus.* In *Galbula* there is a bony box nearly similar to that of *Todus,* but with its sides more strongly concave below, and produced downwards anteriorly into strongly projecting points; the lateral muscle only passes on to the *lower* margin of the box, thus stopping short, as in *Todus* and *Momotus,* of the movable bronchial semirings.

As regards the pterylosis, there is a strange oversight on the part of Nitzsch[2] and Murie[3] as to the condition of the oil-gland, both these observers stating it to be nude. In fact it is, in all the four species of the genus, provided with a very well developed, and even long, tuft of plumes, therein completely differing from that of the Momotidæ, in which the tuft is either altogether absent or quite rudimentary[4]. In both *T. viridis* and *T. dominicensis* I count twenty remiges, ten being secondaries; Nitzsch and Murie give nine, having apparently failed to observe the most proximal, smallest one. Nitzsch's figure of the pterylosis in *Todus,* having nearly certainly been constructed from an examination of the skins only, is not quite accurate—it making the outer pectoral branch to the inferior tract too markedly divergent, and not showing the weaker lines of contour-feathers that run from its apex to the hypopterum. The connexion between the dilated part of the main pectoral tract as it passes on to the breast and the patagial feathering is also made unduly important in his figure, this connexion in reality consisting only of some slight, scattered, irregularly-placed contour-feathers lying outside the main tract on the surface of the breast, between that tract and the patagial one.

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[1] *L. c.* p. 428.

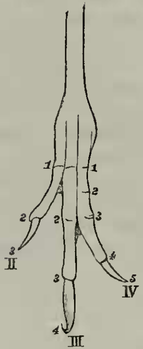
[2] 'Pterylography,' Ray Soc. ed. p. 88.

[3] *L. c.* p. 679.

[4] *Cf.* Garrod, *l. c.* p. 427.

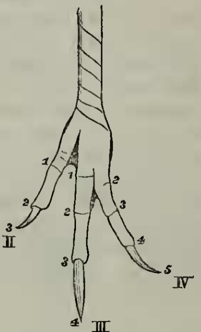
Concerning the external characters of *Todus*, I may remark that the structure of the foot, when carefully compared with that of the Momotidæ, presents considerable differences. In the first place, the long tarso-metatarse, instead of being covered by distinct transverse scutes anteriorly, and by two or more series of smaller scutellæ behind, is "ocreate," being invested anteriorly by a single long scute, without any traces of division; this spreads round both external and internal aspects of the leg, leaving behind a narrow margin of naked skin, with some indication of scutellation. The feet (fig. 2) are much more syndactylous than they are in the Momotidæ. The second digit is united to the third *beyond* the first phalanx of each, and the third to the fourth *beyond* the second joint of the third. In *Momotus* and its allies (vide fig. 3) the union between the second and third digits only extends for about the basal half of their first phalanges, and that of the third and fourth for about half the second phalanx of the former. The feet of *Todus* resemble rather those of the Kingfishers, though the syndactylism has advanced further than in these birds. The position of the hallux is quite normal, it being directed altogether backwards, *not* largely inwards, as imagined by Dr. Murie. The nostrils have a well-defined circular aperture; they lie, unconcealed by the frontal plumes, close to the culmen. Behind them, and extending back as far as the gape, is a well-developed series of rictal vibrissæ, directed downwards and forwards. Another smaller patch of similar vibrissæ, but directed *upwards*, springs, as in *Steatornis*, from the interramal skin of the lower jaw just behind the mandibular symphysis.

Fig. 2.



Foot of *Todus dominicensis.*

Fig. 3.



Foot of *Momotus lessoni.*

Dr. Murie has so elaborately described the osteology of *Todus viridis* that I have not much to add to his account.

In the two skeletons of that species which I possess the manubrium sterni is distinctly bifurcated, therein departing from the Momotidæ and reminding one of the Passeres, and of *Merops*, *Harpactes*, &c.

Careful examination of the skull of that species, as well as of one of *Todus dominicensis*, has shown me that the lower edge of the nasal septum is, for its entire extent, free from the inner edges of the maxillo-palatine plates, a narrow fissure existing on each side between it and them, along which it is possible, with care, to pass the blade of a fine scalpel. In the Motmots (of which I have examined skulls of the genera *Momotus*, *Baryphthengus*, and *Hylomanes*) the maxillo-palatines, though apposed to each other in the middle line, do not actually ankylose for the greater part of their length; so that if the skull be cut across transversely behind the line of union, and the maxillo-palatines with their connected bones separated from the rest of the skull, the two lateral halves of the separated portion fall asunder naturally, there being no union either between the maxillo-palatines themselves (for the greater part of their extent) or between them and the nasal septum, which here does not appear at all in the roof of the mouth in this region. In the Todies, though the septum thus appears, the maxillo-palatines are free altogether both from it and from one another, apparently for their whole extent[1]. If this is so, the Todies are not "*Desmognathæ*," and, inasmuch as they lack the vomer altogether, cannot be included in any other of Prof. Huxley's primary groups of Carinatæ at all!

The vertebræ number 35, exclusive of the pygostyle, as already correctly stated by Murie. Of these I reckon 15 as cervical, 5 dorsal, 8 sacral, and 7 caudal[2].

The close relationship of the Todidæ to the Momotidæ having been so often urged by some of our best naturalists, it will be desirable to point out succinctly some of the important points of difference between them.

The Todidæ, then, differ from the Momotidæ,

(1) In the non-union of the maxillo-palatines, these being attached in the Motmots by harmonic suture.

(2) In the lower margin of the nasal septum appearing in the roof of the mouth between the free edges of the maxillo-palatines. In the Motmots the nasal septum—which ankyloses with the maxillo-palatines anteriorly—does not appear in the palate.

(3) In the complete absence of a vomer, always represented in the Momotidæ by a small, but distinct, ossicle.

(4) In possessing a well-developed lacrymal, quite absent (or early ankylosed with the frontals) in the Motmots.

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[1] It is impossible to state for certain how far anteriorly the maxillæ extend, from a study of the adult skull only; but in *Todus* the osseous roof of the mouth is incomplete as far forwards as the anterior end of the unusually large nares, so that probably it is only by the union of the dentary plates of the præmaxillæ that it is completely ossified here.

[2] Defining as "dorsal" all those, whether ankylosed to the sacrum or not, that bear ribs united directly or indirectly with the sternum. Those that precede, whether or not bearing ribs, are "cervical;" those that follow, and are ankylosed together, are "sacral," the remainder being "caudal."

(5) In the very slight development of the ascending plates of the palatines, well represented in the other group.

(6) In the small amount of ossification in the interorbital septum, this, in the Motmots, being nearly entirely osseous.

(7) In the shape of the sternum, this having four distinct and deep notches (the outer pair being far the larger) never converted into foramina, and separated by delicate xiphoid processes. In the Motmots the inner pair at least (*Hylomanes*), but usually both (*Momotus, Baryphthengus, Eumomota*) are converted into smallish foramina.

(8) In the tendency to bifurcation of the manubrium sterni.

(9) In possessing 8 sacral and 7 caudal vertebræ, as opposed to 11 and 6 in the Momotidæ[1].

(10) In the oil-gland having a large tuft of plumes on its apex, this being quite or almost altogether absent in the Momotidæ.

(11) In the better development of the rictal and mandibular vibrissæ.

(12) In the ocreate tarsus, which is very long, whereas in the Momotidæ it is transversely scutellated and short.

(13) In the much greater syndactylism of the toes.

(14) In the less development of the outer pectoral branch of the inferior tract, which, in *Momotus* at least, is given off much nearer the anterior margin of the breast, and diverges much more than in *Todus*.

(15) In the shape of the tongue in the Motmots, apically frayed-out and brush-like, and with the lacerations of the margin directed forwards, not *backwards*.

(16) In the possession of large and well-developed intestinal cæca, these being *completely absent* in all the Motmots.

(17) In the triangular shape of the obturator internus, this in the Motmots being oval.

(18) In the conformation of the syrinx.

Of special points of resemblance between Todies and Motmots I am unaware of any that can be considered characteristic of these two families as a group, the points in which they do approach each other being equally met with in other allied birds. Thus the simple dorsal tract of *Todus* and *Momotus* reappears in *Alcedo*, as do the crenulated beak-margins in *Merops*[2]. Neither is the termination of the *expansor secundariorum* muscle on the *teres* peculiar to the two groups in question, as it is found, as already observed, in some Kingfishers, as well as in *Steatornis*.

The resemblance between the termination of the *tensor patagii* tendons in the two families is perhaps the best-marked feature of special resemblance; but, as already pointed out, though the arrangement is similar, it is not identical, whilst, on the other hand, that characterizing the Todies could easily be produced by a slight modification of that found in some of the other groups of Anomalogonatæ.

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[1] In all the Momotidæ I have examined (including the genera *Momotus*, *Baryphthengus*, and *Hylomanes*) this is the number of these vertebræ, the total being 37, except *Baryphthengus*, which has only 36, by the reduction of its dorsal vertebræ to 4 (C. 15, D. 4, S. 11, Cd. 6=36). Dr. Murie, after stating the number of the vertebræ in the Motmots to be 36, 37, or 38, curiously enough gives the number characteristic of *Todus* (35) as one of the characters of his group "Serratirostres," in which he includes the Motmots (Ibis, 1872, p. 410)!

[2] As already pointed out by Murie, Ibis, 1872, p. 398.

In the face, then, of the many important differences that exist in all parts of the structure of the two forms, and in the absence of any special features common to them, I cannot agree to the proposition that the Todies are more closely related to the Motmots than to any other group.

In the possession of cæca and in the conformation of their pectoral tract the Todies agree with all Garrod's "Passeriformes," with one of the families of which indeed, the *Galbulidæ*, one of the most acute ornithologists that has ever lived, the late Mr. Blyth, associated them as a special group, "Angulirostres"[1]. On the other hand, in possessing a well-developed tuft to the oil-gland, the Todies differ altogether from the Passeriform series of Anomalogonatæ. Detailed comparison of the structure of the Todies with that of the other families of this great group is unnecessary, none of them possessing features indicating such affinities to the former as to render probable any particular genetic connexion of the two.

As Dr. Murie has already remarked, "*Todus* is inconsistent in several respects,"[2] a truth made more obvious by the facts above recorded. In the possession of *cæca* combined with the tuft to the oil-gland, *Todus* presents an exception to Garrod's definition of his group Anomalogonatæ[3], though it agrees with all of them in the absence of both the ambiens and accessory femoro-caudal muscles. Nevertheless it is certain, from its characters generally, that *Todus* is an Anomalogonatous bird, though its isolation from any other of the families of that group seems to me to preclude its insertion in the Piciformes, Passeriformes, or Cypseliformes of Garrod[4]. It is impossible, I think, to say that *Todus* is more clearly related to any of the Piciformes than it is to the Passeriformes; and to include it the definitions of either of those groups would have to be altered. I propose, therefore, to create a group of equivalent value to those just named, which may be called "Todiformes," and of which *Todus* is the sole living representative.

Next, as to the meaning of these facts. I think few ornithologists who have carefully considered the question can doubt that the "Anomalogonatæ" of Garrod are a natural group of birds[5], *i.e.* one descended from a common ancestor. On this view this ancestor must have possessed the *sum* of the characters—supposing, unless there is reason for the contrary, that the latter have not been *re*-developed, and excluding those that may reasonably be supposed to be adaptive, or more recently acquired—exhibited by its existing descendants. As most of the Anomalogonatæ possess *either* well-developed cæca, *or* a tufted oil-gland, whilst *all* lack the ambiens and accessory femoro-caudal muscles, it may be presumed with some certainty that the ancestor of the group generally possessed both well-developed cæca and a tuft to the oil-gland—the first having disappeared in the *Piciformes*, the latter in the *Passeriformes*, and both in the highly specialized *Cypseliformes*: at the same time it was destitute of both ambiens and accessory femoro-caudal muscles. The existence of *Todus* therefore exactly substantiates what might have justly been inferred *à priori* on purely theoretical grounds; whilst its insular habitat, the small number of species, and their diminutive size are exactly what might have been expected of a very ancient and synthetic form, which has been unable to hold its own, on the larger areas, with more lately developed and highly specialized forms. On the other hand, it is not to be expected, on the doctrine of descent, that any *living* form, however synthetic, should be *exactly* intermediate between any other two *living* groups, because it is nearly certain to have been modified in some points *pari passu* with those forms to which it (or, rather, its ancestors more or less remote) gave origin. There are structures in other families of the Anomalogonatæ—as, *e. g.*, the *biceps*-slip of the Caprimulgidæ, the *gluteus quintus* of the Coliidæ, the vomer and the *gluteus primus* of several—which are not represented at all in *Todus*. These *may*, of course, have been independently reacquired; inasmuch as, however, they are all structures met with in the Homalogonatous birds—from some form of which I cannot doubt that the Anomalogonatæ are descended—it is more probable that they have been inherited directly from a common ancestor which possessed these along with the other structural characters of the Anomalogonatæ. That one or more of such structures should have disappeared in *Todus*, though present in the hypothetical common ancestor, is in no way surprising. I submit, in conclusion, therefore,

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[1] Charlesworth's Mag. Nat. Hist. ii. 1838, p. 361.

[2] P. Z. S. 1872, p. 678.

[3] P. Z. S. 1874, p. 118; Coll. Papers, p. 216.

[4] *L. c.* p. 222.

[5] It is nearly certain that the Cuculidæ and Musophagidæ, as also the Psittacidæ, are in no way related to the other so-called Picariæ.

(1) That *Todus* is a much isolated form, with affinities to both the Passeriformes and Piciformes of Garrod.

(2) That it cannot be substantiated that *Todus* is clearly allied to any particular living form of these.

(3) That this view may be most correctly expressed by making a group *Todiformes*, equivalent to *Passeri-*, *Pici-*, and *Cypseliformes*, for the sole reception of the genus *Todus*.

(4) That in all probability *Todus*, though in some respects much modified and specialized, represents more nearly than any other existing form the common stock from which all the living groups of Anomalogonatous birds have been derived.